

CLAIMS

We claim:

1. A positioning information distribution system comprising:

- 5 an information processing station connected to a data network accessible by wireless communication, said information processing station having a database;
- 10 a receiving station including a positioning system receiver and a transmitter, said positioning system receiver receiving positioning information from a positioning system and transmitting said positioning information to said information processing station via a data link for storage at said database; and
- 15 a mobile unit including a positioning system receiver and a wireless receiver, said mobile unit receiving said positioning information from said information processing station via said data network using wireless communication.

20 2. The system of claim 1, wherein said positioning system is a cellular telephone network in which triangulation based on said cellular telephone network is performed for determining a position of said mobile unit.

25 3. The system of claim 1, wherein said positioning system is a global positioning system (GPS), said positioning system receiver is a GPS receiver and said positioning information is GPS satellite information.

30 4. The system of claim 3, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said satellite information from said information processing station via said data network for computing a measured position of said mobile unit.

5. The system of claim 3, wherein said information processing station distributes said satellite information by broadcasting said satellite information through said data network; and said mobile unit receives said broadcast
5 satellite information through wireless communication.

6. The system of claim 3, wherein said mobile unit further comprises a wireless transmitter; and said information processing station distributes said satellite information upon request from said mobile unit and transmits
10 said satellite information through said data network to said mobile unit using wireless communication.

7. The system of claim 3, wherein said satellite information comprises ephemeris information defining the orbital parameters of said GPS satellites.

8. The system of claim 7, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said ephemeris information from said information processing station via said data network for computing a measured position of said mobile unit.
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9. The system of claim 3, wherein said satellite information comprises one or more navigation messages transmitted by said GPS satellites.
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10. The system of claim 9, wherein said satellite information comprises satellite health information of said
25 GPS satellites.

11. The system of claim 10, wherein said mobile unit discards satellite information received for a first one of said GPS satellites when said satellite health information for said first one of said GPS satellites indicates a
30 malfunctioning status.

12. The system of claim 9, wherein said satellite information comprises satellite^A almanac information of said GPS satellites.

5 13. The system of claim 12, wherein said mobile unit uses said satellite almanac information received from said information processing station^A via said data network for locating one or more of said GPS satellites above the horizon.

10 14. The system of claim 3, wherein said satellite information comprises satellite^A clock correction factors of said GPS satellites.

15 15. The system of claim 3, wherein said satellite information comprises one or more of the following information: the actual navigation bits of the navigation message transmitted by said GPS satellites^A, the Doppler shifts information for said GPS satellites, and time and frequency information for synchronizing a clock of said mobile unit to a GPS time.

20 16. The system of claim 3, wherein said satellite information comprises differential^A correction data computed by said receiving station.

25 17. The system of claim 16, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said satellite information and said differential correction data^A from said information processing station via said data network for computing a corrected measured position of said mobile unit.

18. The system of claim 3, wherein said receiving station is stationary.^A

19. The system of claim 3, wherein said receiving station is in direct line-of-sight of one or more GPS satellites continuously and substantially uninterrupted.

20. The system of claim 3, wherein said data link is a wireless data communication link.

21. The system of claim 3, wherein said data link is a direct wired link.

22. The system of claim 21, wherein said data link is a T1 data link.

23. The system of claim 3, wherein said data link is a communication data link through said data network.

24. The system of claim 3, further comprising:
a wireless network gateway connected to said data network, said gateway providing wireless communication service to said mobile unit;
wherein said mobile unit communicates over a wireless data communication link with said gateway for receiving information from said data network.

25. The system of claim 24, wherein said wireless communication service comprises communicating using a packet data structure.

26. The system of claim 24, wherein said wireless communication service comprises communication via a cellular telephone modem.

27. The system of claim 26, wherein said wireless communication service uses a short message service of a cellular communication structure.

28. The system of claim 24, wherein said wireless communication service comprises communication over a satellite data link.

29. The system of claim 3, wherein said data network comprises a publicly shared network such as the Internet.

30. The system of claim 3, further comprising:

a data processing station connected to said data network accessible by wireless communication, said data processing station having a database including maps; and

said mobile unit further including a wireless transmitter;

wherein said GPS receiver of said mobile unit receives time of arrival information from GPS satellites and said mobile unit transmits said time of arrival information to said data processing station via said data network; and

wherein when said data processing station receives said time of arrival information, said data processing station computes a measured position for said mobile unit using satellite information distributed by said information processing station.

31. The system of claim 30, wherein said data processing station provides area maps to said mobile unit based on said measured position of said mobile unit.

32. The system of claim 30, wherein said data processing station provides travel-related information to said mobile unit based on said measured position of said mobile unit.

33. The system of claim 3, wherein said mobile unit is a cell phone and said information processing station broadcasts said satellite information to said cell phone.

5 34. The system of claim 33, wherein a user of said mobile unit places a 911 call using said cell phone and determines its position using said broadcast satellite information from said information processing station.

10 35. The system of claim 33, wherein a user of said mobile unit obtains location-dependent information using said cell phone.

~~36.~~ A GPS satellite information distribution system comprising:

15 an information processing station connected to a data network accessible by wireless communication, said information processing station having a database;

20 a plurality of receiving stations, each including a global positioning system (GPS) receiver and a transmitter, said GPS receiver receiving GPS satellite information from GPS satellites and transmitting said GPS satellite information to said information processing station via a data link for storage at said database; and

25 a mobile unit including a GPS receiver and a wireless receiver, said mobile unit receiving said GPS satellite information from said information processing station via said data network.

37. The system of claim 36, wherein said plurality of receiving stations are disposed to receive GPS satellite information from all of 24 GPS satellites in earth's orbit.

38. The system of claim 36, wherein each of said GPS satellites is observed by at least two of said plurality of receiving stations.

5 39. The system of claim 36, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said satellite information from said information processing station via said data network for computing a measured position of said mobile unit.

10 40. The system of claim 36, wherein said information processing station distributes said satellite information by broadcasting said satellite information through said data network; and said mobile unit receives said broadcast satellite information through wireless communication.

15 41. The system of claim 36, wherein said mobile unit further comprises a wireless transmitter; and said information processing station distributes said satellite information upon request from said mobile unit and transmits said satellite information through said data network to said mobile unit using wireless communication.

20 42. The system of claim 36, wherein said satellite information comprises ephemeris information defining the orbital parameters of said GPS satellites.

25 43. The system of claim 42, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said ephemeris information from said information processing station via said data network for computing a measured position of said mobile unit.

30 44. The system of claim 36, wherein said satellite information comprises one or more navigation messages transmitted by said GPS satellites.

45. The system of claim 44, wherein said satellite information comprises satellite health information of said GPS satellites.

5 46. The system of claim 45, wherein said mobile unit discards satellite information received for a first one of said GPS satellites when said satellite health information for said first one of said GPS satellites indicates a malfunctioning status.

10 47. The system of claim 44, wherein said satellite information comprises satellite almanac information of said GPS satellites.

15 48. The system of claim 47, wherein said mobile unit uses said satellite almanac information received from said information processing station via said data network for locating one or more of said GPS satellites above the horizon.

49. The system of claim 36, wherein said satellite information comprises satellite clock correction factors of said GPS satellites.

20 50. The system of claim 36, wherein said satellite information comprises one or more of the following information: the actual navigation bits of the navigation message transmitted by said GPS satellites, the Doppler shifts information for said GPS satellites, and time and
25 frequency information for synchronizing a clock of said mobile unit to a GPS time.

51. The system of claim 36, wherein said satellite information comprises differential correction data computed by said receiving stations.

52. The system of claim 51, wherein said mobile unit receives time of arrival information from at least three GPS satellites and receives said satellite information and differential correction data from said information processing station via said data network for computing a corrected measured position of said mobile unit.

53. The system of claim 36, wherein said plurality of receiving stations are in direct line-of-sight of one or more GPS satellites continuously and substantially uninterrupted.

54. The system of claim 36, wherein said data link is a wireless data communication link.

55. The system of claim 36, wherein said data link is a direct wired link.

56. The system of claim 55, wherein said data link is a T1 data link.

57. The system of claim 36, wherein said data link is a communication data link through said data network

58. The system of claim 36, wherein said data network comprises a publicly shared network such as the Internet.

59. A method for distributing global positional system (GPS) satellite information over a data network to a mobile unit, comprising:

receiving in a receiving station GPS signals including GPS satellite information transmitted by GPS satellites;

transmitting said GPS satellite information to an information processing station through a data network;

receiving in said information processing station
said GPS satellite information and storing said GPS
satellite information in a database for later
retrieval; and

5 transmitting said GPS satellite information to a
mobile unit through said data network using wireless
communication.

60. The method of claim 59, further comprising:
receiving in said mobile unit said satellite
10 information transmitted by said information processing
station;
receiving in said mobile unit a satellite signal
transmitted by said GPS satellites;
determining a time of arrival information based on
15 said satellite signal; and
computing a measured position of said mobile unit
using said satellite information and said time of
arrival information.

61. The method of claim 59, wherein said transmitting
20 said GPS satellite information to a mobile unit through said
data network using wireless communication comprises:
broadcasting said satellite information through
said data network.

62. The method of claim 59, wherein said transmitting
25 said GPS satellite information to a mobile unit through said
data network using wireless communication comprises:
transmitting a request from said mobile unit to
said information processing station;
retrieving said satellite information in said
30 information processing station based on said request;
and

transmitting said retrieved satellite information
to said mobile unit via said data network.

63. The method of claim 59, wherein said receiving in
a receiving station GPS signals comprises:

5 receiving in a plurality of receiving stations GPS
signals including GPS satellite information transmitted
by GPS satellites.

64. The method of claim 63, wherein said plurality of
receiving stations receive GPS satellite information from
10 all of 24 GPS satellites in earth orbit.

65. The method of claim 63, wherein each of said GPS
satellites is observed by at least two of said plurality of
receiving stations.

66. The method of claim 59, wherein said satellite
15 information comprises ephemeris information defining the
orbital parameters of said GPS satellites.

67. The method of claim 66, further comprising:
receiving in said mobile unit said ephemeris
information transmitted by said information processing
20 station;
receiving in said mobile unit a satellite signal
transmitted by said GPS satellites;
determining a time of arrival information based on
said satellite signal; and
25 computing a measured position of said mobile unit
using said ephemeris information and said time of
arrival information.

68. The method of claim 59, wherein said satellite
information comprises one or more navigation messages
30 transmitted by said GPS satellites.

69. The method of claim 68, wherein said satellite information comprises satellite health information of said GPS satellites.

70. The method of claim 69, further comprising:

5 receiving in said mobile unit said satellite health information transmitted by said information processing station for a first one of said GPS satellites; and

10 discarding satellite information received in said mobile unit for said first one of said GPS satellites when said satellite health information indicates said first one of said GPS satellites to be malfunctioning.

71. The method of claim 68, wherein said satellite information comprises satellite almanac information of said
15 GPS satellites.

72. The method of claim 71, further comprising:

receiving in said mobile unit said satellite almanac information transmitted by said information processing station; and

20 locating in said mobile unit a first one of said GPS satellites above the horizon of said mobile unit based on said satellite almanac information.

73. The method of claim 59, wherein said satellite information comprises satellite clock correction factors of
25 said GPS satellites.

74. The method of claim 59, wherein said satellite information comprises one or more of the following information: the actual navigation bits of the navigation message transmitted by said GPS satellites, the Doppler
30 shifts information for said GPS satellites, and time and

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frequency information for synchronizing a clock of said
mobile unit to a GPS time.

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